Space Weather Technical Forecast

Issued on Sunday, 16 October 2022 at 01:19 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant space weather is expected.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has returned to Low or Very Low levels, with isolated C-flares, the largest of which a long duration C6.1 flare peaking at 15/1811 UTC. There are three numbered regions and one unnumbered region on the visible disk. All are inactive and stable, though AR3122 is showing signs of increased magnetic complexity with an additional trailing group of spots emerging. Significant magnetic looping is still visible from AR3112, despite it having rotated off the west limb. There are also a number of filaments on the Earth-facing disc, one of these erupted in the southwest at 14/2200 UTC. Modelled results indicate that the bulk of the ejecta will pass below Earth orbit, and although a weak glance around midnight UTC on the 18th is possible, no significant impacts are anticipated. Another filament in the southwest erupted around 15/1430 UTC, no evidence of a CME from this event is visible in imagery.
No other Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by ACE and DSCOVR at L1, is indicative of the connection with CH32, having steadily increased through the period from 450 km/s to around 550 km/s. Density was just above average or average. The IMF declined from Moderate levels, around 12 nT to Weak levels below 8nT. The north-south component, Bz, fluctuated moderately at first but was predominantly northward directed, but has again become weak in recent hours. The phi angle was mostly negative (towards the Sun). Geomagnetic activity was G1/Minor Storm 15/0000-0300 UTC and Active (Kp 4) 15/1800-2100 UTC. Otherwise, Quiet to Unsettled (Kp 1 to 3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16, has remained at background levels. High energy electron flux at GOES16 (greater than 2MeV) was mostly at Background levels. The associated fluence was well below the Active (1e8 integrated pfu) threshold. The 15/2359 UTC observation was 1.73e6 integrated pfu.

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Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be mostly Low, though AR3122 will need to be monitored for further development. There remains a slight chance at first that AR3112 may produce a significant flare from beyond the west limb.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs, however the peripheral effects of CMEs passing south of Earth late day 1 (16th) or 2 (17th), and again late on day 3 into 4 (18th-19th) may be observed. Otherwise, ongoing fast wind influence from CH32/- is expected to ease towards background. Geomagnetic activity is forecast to be Quiet to Unsettled, but with a chance of Active intervals early or late on day 1 (16th), or early day 2 (17th), and again late on day 3 into day 4 (18th-19th).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) is expected to be at background levels. High energy electron flux (greater than 2MeV) has eased to near background levels, although flux levels are likely to recover during the period, perhaps reaching High at diurnal peak. The associated 24hr fluence is expected to persist below the Active (1e8 integrated pfu) threshold, but likely rising later in the period. There is a chance of Active fluence by the end of day 3 (18th).

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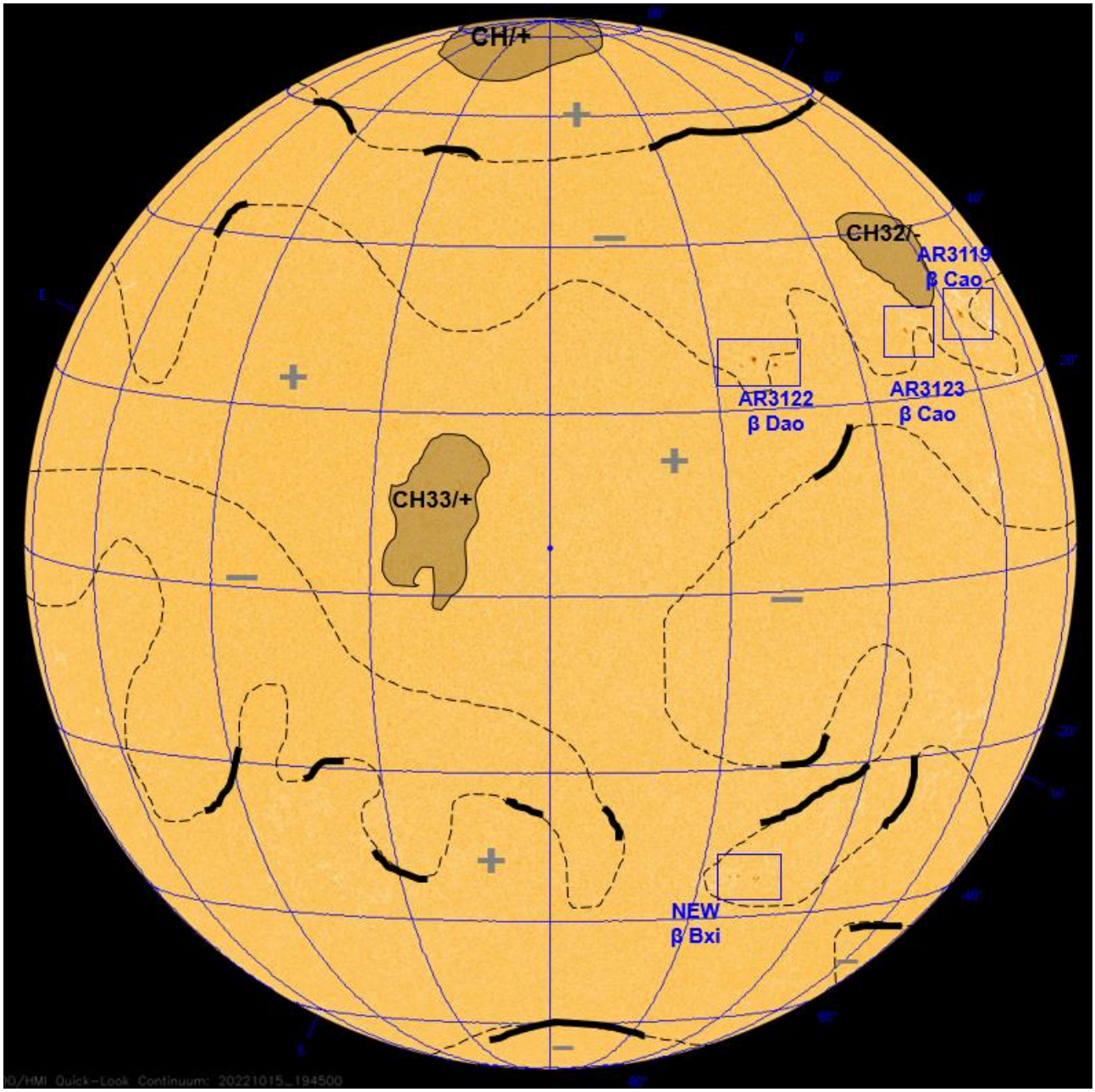
Figure 1. Solar Analysis Valid 15/2000 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs, however a CME was observed from a filament eruption from the southern centre disc early on the 13th. The bulk of the material is expected to pass below Earth's orbit, however peripheral glancing effects are possible, most likely late day 1 (16th) on early day 2 (17th). Similarly, another filament erupted in the southwest at 14/2200 UTC. Modelled results indicate that the bulk of the ejecta will also pass below Earth orbit, and although a weak glance late on day 3 (18th) or early day 4 (19th) is possible, no significant impacts are anticipated.
Current fast wind enhancement from CH32/-, is expected to gradually easing back towards background through the period. No other coronal hole features are expected.
Geomagnetic activity is forecast to be Quiet to Unsettled, but with a chance of Active intervals early day 1 (16th) from ongoing fast wind effects, or with any possible influence from the glancing CMEs late day 1 (16th) or early day 2 (17th), and again late on day 3 (18th) into day 4 (19th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	5	5	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
13/1610	Partial	Filament eruption	S-centre	408km/s	Missing	Chance of peripheral influence late 16th or early 17th
15/0600	Partial	Filament eruption	SW	520km/s	Missing	Chance of peripheral influence late 17th or early 18th

Figure 2: BGS Estimated Kp index

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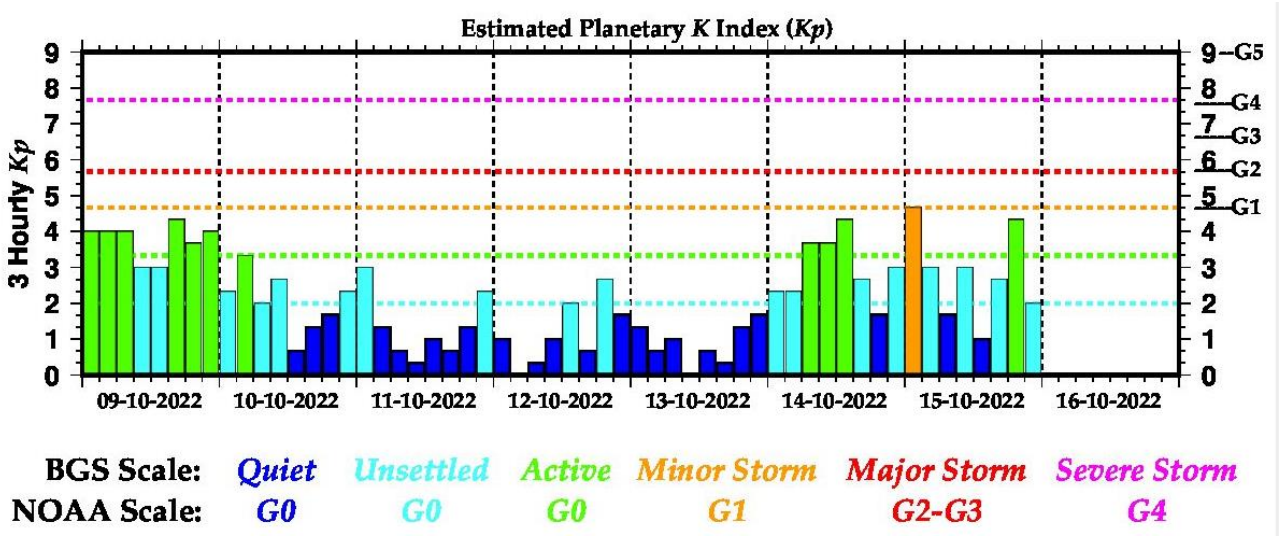

Radio Blackouts - X-Ray Flares:

Solar activity has returned to Low or Very Low levels, with isolated C-flares. AR3112 has now rotated off the Earth-facing disc, over the northwest limb. However, with significant magnetic looping still present and visible on SDO imagery from this region, a slight risk of further M-flares is maintained through day 1 (16th), reducing thereafter. Of the three numbered regions on the disk AR3112 (Dao/Beta) is showing signs of increasing complexity. The two other numbered regions and one other unnumbered region in the southwest appear stable and relatively weak. A returning region may begin to appear at the southeast limb by the end of the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is currently at background levels and expected to remain at this level. AR3112 has now rotated off the disc, and whilst far-sided flares can produce a proton response at Earth, the lack of response from recent M-flares reduces this potential.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

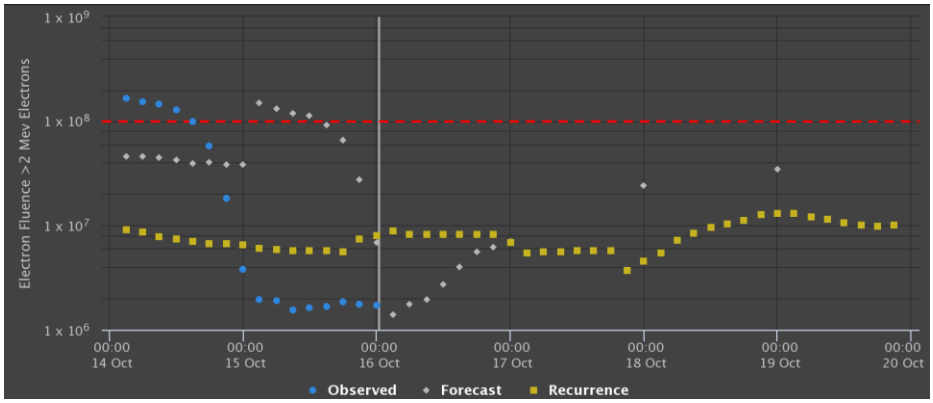
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES-16 has been at background, having dropped out due to impact of the recent fast wind arrival from CH32/-. Electron flux is expected to increase again as solar winds ease, rising to Moderate, and perhaps reaching High at diurnal peak, although with low confidence.
The associated 24 hour electron fluence is likely to remain below the Active level, but with a rising trend as flux levels increase. There is a chance that this may approach, or perhaps exceed Active by day 3 or day 4 (18th or 19th). REFM has yet to correct for the current fast winds, so is unreliable, despite also suggesting that fluence levels will remain below the Active level.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	5	20	30	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: MOSWOC REF Model. Observed values well below 1e8 Active levels.



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